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VIEWS, NEWS AND INTERVIEWS.

The residence occupied for many years by the late Sir John Pender, of Atlantic cable fame, at 18 Arlington street, London, has been purchased by Sir Humphrey de Trafford.

A correspondent of *The Lancet*, London, who conducted a small Roentgen-ray gallery at a bazaar, relates the following amusing experience: "An elderly gentleman of prosperous appearance objected that the show was not 'up to date,' as he had 'read somewhere in a newspaper that now you can see the liver palpitating and the heart circulating.' A young and anxious mother asked to see if her little boy had really swallowed a threepenny bit, as he was uncertain himself. She had read in the papers that a great doctor, Sir Something Blister, in a speech in a large meeting in Liverpool, a little while ago, said that a halfpenny had been seen in a boy's 'sarcophagus'! A girl of the domestic-servant class asked the curator in confidence to 'look through her young man unbeknown to him, while he looked at the picture, to see if he was quite healthy in his internals.'"

Rossland, B. C., with a population of 7,000, has just installed a district messenger call plant with 200 boxes, and will add to the plant in the Spring.

A syndicate has secured an option on the controlling interests in the Leominster, Mass., & Clinton Street Railway Company and the Marlboro Street Railway Company, and which is negotiating for a contract of the franchise granted the Marlboro & Worcester Railway Company, to lay tracks in Worcester, Shrewsbury, Northboro and Westboro. The intention of the syndicate is to secure a through line from Leominster to Boston via South Framingham. New roads are to be built from Clinton, through Berlin, to Northboro, and from Westboro to Hopkinton, which, with new construction added to the present service, will make a compiete network of street railways in Worcester County and give the desired electric communication with Boston from this section.

Arthur de Cima, United States Consul at Mazatlan, recently arrived in San Francisco. He is the owner of the electric light plant and telephone system in Mazatlan. His electric plant has a capacity of 1,500 lights, but as many more are needed, he will make arrangements for extra electric supplies while in the United States. He will also get extra supplies for his telephone system. There are 100 telephones in the system now, but more are required. He has a franchise for putting in an electric street-car system in Mazatlan, and has come to get about $40,000 worth of cars, rails and other apparatus.

A Persian philosopher, on being asked by what method he had acquired so much knowledge, answered: "By not being prevented by shame from asking questions when I am ignorant."

It is proposed to dispose of impounded and unredeemed hogs in Macon, Ga., by electrocution. Successful experiments on rats have been made.

Powerful Horizontal Turbines.

The Dayton Globe Iron Works Company, of Dayton, Ohio, recently finished the construction and erection for the Boston & Montana Consolidated Copper and Silver Mining Company, of Great Falls, Mont., of what is probably the largest and most powerful pair of horizontal turbines, for the head of water under which they will operate, that have ever been built by any turbine manufacturers in the world.

These turbines are of the new American pattern of the latest design,

Fig. 1.—Horizontal Turbines for the Great Falls, Montana, Plant.

57 inches in diameter, and under the head of 50 feet will develop 3,945.6 horse-power.

The turoines are placed on a cast-iron draft chest and discharge centrally through a draft tube 10 feet in diameter. They are incased in an iron flume 14 feet 4 inches in diameter, 32 feet 6 inches long, made of one-half-inch tank steel, with cast-iron heads, and the flume is mounted on two pairs of double I beams, 20 inches deep and 38 feet long.

The shaft in the wheels is 10 inches in diameter, 42 feet 2 inches long, made in two sections, and its weight is over five tons. The clamp coupling which connects these two sections of shafting in the center of the draft chest weighs considerably more than one ton. There are stands, weighing 8,000 pounds each, outside of flume at each end, which carry the journal boxes for this shaft.

The two turbines, with their complete outfits as shown in Fig. 1, weigh approximately 250,000 pounds, and in their design and construction reflect great credit upon the engineering skill of the Dayton Globe Iron Works Company, and are also an excellent example of their ability to construct this class of machinery on a mammoth scale.

These turbines are to operate two Westinghouse electric generators, one coupled directly to each end of the shaft, which runs from 144 to 160 revolutions per minute, and will be used for electrolytic refining. The varying revolutions are required in order to increase or diminish the current, as conditions may require.

The power of these wheels is also utilized for driving an arc-light dynamo and the two 50-horse-power exciters for the large generators, the power being transmitted from wheel shaft to dynamo by means of a 20-inch double leather belt, and there still remains a surplus power in the wheels, which is not being utilized at present.

It is further estimated that if a pair of these 57-inch new American turbines of this design and capacity were placed in operation on the new water-power at Niagara Falls under 140 feet head, they would develop 18,494 horse-power, and would require a shaft 15 inches in diameter to safely transmit the power, estimating the power to be taken off at each end of the shaft, as is the case at Great Falls, Mont.

Before shipping these wheels to Great Falls the Dayton Globe Iron Works Company had them tested at the testing flume of the Holyoke Water Power Company, Holyoke, Mass., and both the right-hand and left-hand turbine showed an average efficiency from three-quarter to whole gate, inclusive, of 81¼ per cent, which is a remarkable performance, particularly in view of the fact that these

turbines were the first ones ever made of that diameter by the Dayton Globe Iron Works Company. These wheels were sold on a guarantee that they would show an average efficiency of 80 per cent from three-quarter to whole gate, and would develop 2,800 horse-power under 40 feet head, and they exceeded their guarantee both in horse-power and efficiency.

OBITUARY.

David Leonard Barnes, consulting engineer, died in New York city on December 15. He was employed by the Baldwin-Westinghouse combination, and designed for it a set of standard electric locomotives, two or three of which have already been built. His principal office was in Chicago, and during the equipment of the Alley Elevated Railroad there, he acted as consulting engineer for that road. Mr. Barnes had been for about eight years one of the editorial staff of the *Railroad Gazette*, of New York. He was a member of the American Society of Civil Engineers, the American Society of Mechanical Engineers, the Institution of Civil Engineers, London; the Western Society of Engineers, and various other scientific and technical bodies. He was a member of the Union League Club, of Chicago; the Manufacturers' Club, of Philadelphia, and the Engineers' Club, of New York. Mr. Barnes was born near Providence, R. I., August 23, 1858, and was educated at Brown University and the Massachusetts Institute of Technology, and had received the degree of Master of Arts from Brown University.

A Brooklyn Car Barn Burned.

The car barn of the Nassau Electric Railroad Company at Rockaway avenue and New Lots road, Brooklyn, N. Y., was burned at one o'clock in the morning of December 18. The cause of the fire was an overheated motor, which was in a car that had been used in the early part of the night. When it was run into the house at midnight nobody noticed that the motor was red-hot. Soon after the car had been run in the flames burst forth.

It had been one of the first cars run into the barn and was penned in the center of a field of cars. This made it difficult to get at it, and delayed discovery of the blaze, giving the fire a start it would not otherwise have had. Before the fire was put out 15 cars were either burned or badly damaged by the flames. In addition, one end of the building was burned down and part of the roof destroyed. The loss is estimated at $50,000.

Mr. J. B. Parsons, general manager of the West Chicago Street Railway Company, has accepted the position of general manager of the Union Traction Company, of Philadelphia, and will assume the management January 2. Mr. Parsons's appointment to his new position was foreshadowed in the ELECTRICAL REVIEW for November 18, 1896.

Cataphoresis in Dentistry.

[*From the New York Sun.*]

This is all about cataphoresis. Maybe you don't know what that is. Maybe you don't think you want to know, either. Anybody who feels that way, however, is making a great mistake—that is to say, anybody with teeth. Cataphoresis, to speak plainly, is going to revolutionize dentistry. It is going to fill the most sensitive teeth, those that generally go hippity-hop at the first touch, without causing them a single murmur.

Strictly speaking, cataphoresis is not going to fill the teeth in this beautiful painless manner, but it is going to enable the dentist so to fill them. Cataphoresis is not a quack medicine; it is a discovery in scientific processes. The dentists, to quote one of them, "are wild over it." If they are wild over it, what will their patients be? A member of the profession here in New York said to a *Sun* reporter:

"When the process is perfected we shall be able to guarantee absolutely to fill the most sensitive tooth without giving pain. In fact, we can do that now, if we happen to have the necessary apparatus and the time to give to it. Cataphoresis is the process of forcing cocaine and other medicaments into a tooth by means of electricity."

"Is it really a new thing?"

"Yes. It has been gradually evolved, and is not yet perfected, but it has been brought to a point where dentists are employing it in their practice. The only difficulty now is in the length of time it requires. It takes from 10 minutes to half an hour completely to anæsthetize a tooth. All that time, you see, before the dentist can even begin to prepare the cavity. Of course, with some patients—the nervous ones who make you stop every little while and who 'act up' generally—one saves that much time in being able to work rapidly when the tooth is finally ready; but time is so valuable that dentists will not be satisfied to spend half an hour in preparing a tooth. Neither will all patients be willing to pay for that extra time; what we are working on now, therefore, is some means of shortening the process.

"Cataphoresis, in a general sense, is the movement of fluids from the positive to the negative pole of a battery. It is not a new discovery. It has been known and practiced occasionally for over 30 years, but it is only very recently that the early difficulties have been overcome so that it could be accepted by practitioners at large. A year ago a progressive New York dentist gave to the profession the results of his experiments. Here they are, summed up in all their bearings, and I guess that everybody that ever had a tooth filled will be glad to read them."

The dentist produced a pamphlet which gave a series of experiments, with the following conclusions:

"Cocaine solutions alone of from 15 to 20 per cent, applied in sensitive cavities for 10 or 20 minutes, do not modify the sensitiveness. The electric current alone applied to sensitive teeth does not perceptibly modify the sensitiveness, but cocaine solutions and the electric current together do completely anæsthetize the tooth.

"This treatment renders possible, for nervous and hyper-sensitive organizations, desirable operations, which, without some such means, are utterly impossible. It also enables the operator to perform much more satisfactory operations for sensitive children from 12 to 16 years of age, and to do these operations, which would otherwise be entirely too formidable to contemplate, with no objection from the little patient and with no danger of exhaustion afterward.

"Some of my first experiments were made in my own mouth; stronger currents were used than I dare to apply to the mouths of my patients, and deep anæsthetic effects were obtained. No ill results followed, and the tooth is normal in its sensitiveness after nearly a year's test. As to the applicability of the method, I find that it is almost universal. The exceptions are in the cases of the comparatively rare subjects who are not readily affected by cocaine, and the occasional case where the difficulties of insulating the tooth or cavity are too great.

"After one experience with the process, the sensation is readily borne, even by sensitive children of 12 or 14 years. In fact, they are often enthusiastic about its use.

"It is my habit, as soon as I have opened into a sensitive cavity, to make an application lasting from eight to twelve minutes. If I have reason to expect difficulty with the case, I make the application longer. If the first application is not sufficient for all I wish to do, I repeat it.

"I have some 10 or 12 cases on record where 20 to 30 minutes have been needed to get a sufficient effect. These were all cases where both patient and operator felt compensated for the time spent. Most of them were either extremely sensitive teeth, or subjects who could bear but little current, and several of these cases would have been all but impossible without the aid of this method.

"On the other hand, I have numerous cases where ten or even eight minutes have been ample time for successful results.

"Having reached a voltage likely to be sufficient, I allow it to stand at that point till the end of the application.

"Fifteen to 20 volts will usually be attained in seven or eight minutes. In many cases, with small cavities and little sensitiveness to the current, 25 or 30 volts may be marked in the same time."

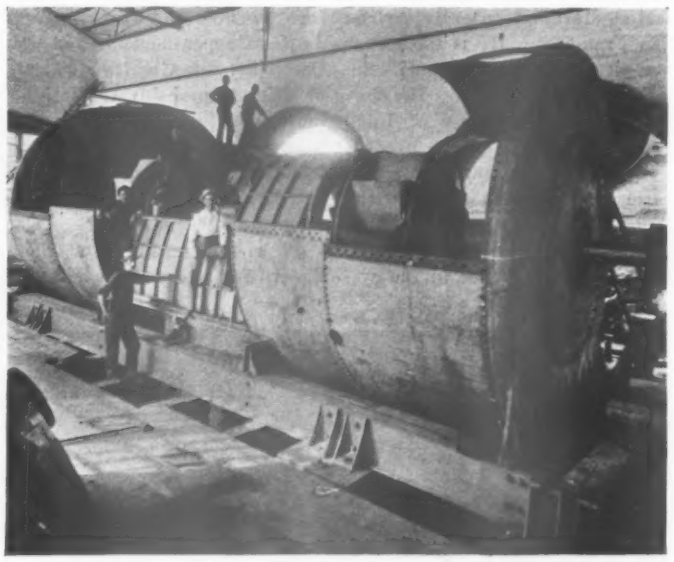


FIG. 2.—TURBINES FOR THE GREAT FALLS, MONT., PLANT IN PROCESS OF CONSTRUCTION.

Electric Motors on the Brooklyn Bridge.

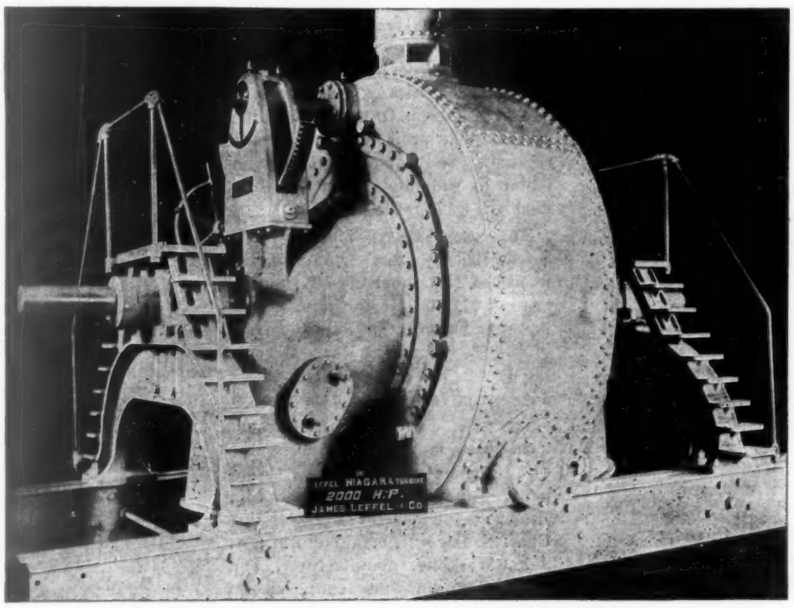
The following paragraph is from the annual report of the trustees of the New York & Brooklyn Bridge, submitted on December 14:

"While confident that cable traction on the bridge railway is, as shown by its long and successful use, eminently reliable, economical and safe, the trustees, feeling called upon to determine by test under service as to whether a better system of traction may not be had, have arranged for the installation of an electric traction plant, whereby trains may be switched at the station, and work therefor is now in hand. The trustees, after such a trial, decided to have the tracks at the stations provided with an electric system, whereby switching of trains at terminals could be done by electric motors instead of by locomotives, as heretofore, and subsequently to have the main tracks over the structure equipped, so that when the running cable, from any cause, failed to haul a train in transit, it could be reinforced by the electric motors. Contracts were entered into whereby 20 passenger cars were to be equipped each with four electric motors for propulsion: also for two steam engines and dynamos for the production of electric current, a battery of boilers to make the steam for these engines, and the several minor parts of the complete system were to be supplied. The undertaking as outlined is nearly complete. At the closing of this report, 12 of these electric motor cars are finished, and trains for several days have been switched and run over the railway by them, the locomotives being dispensed with. The results so far obtained, from the short trials made, appear to be satisfactory."

It is proposed to build an elevated electric road running along the shore from Copenhagen to the woods at Charlottenlund.

James Leffel & Company's "Niagara" Type Water-Wheel.

The accompanying illustration shows one of the four large water-wheels supplied by James Leffel & Company, of Springfield, Ohio, to the plant of the Niagara Falls Hydraulic Power and Manufacturing Company at Niagara Falls, N. Y. This wheel is known as the "Niagara" type and is a double discharge turbine especially adapted in design and detail for the plant where it is in successful use. The weight of each of these four wheels is 50 tons. The details of the design were worked out by Mr. A. F. Sparks, chief engineer for James Leffel & Company. The wheels stand on very strong, heavy, double steel beams, placed upon solid foundations of stone, the whole being of a most substantial character. These steel beams span the tail-race, and from the same framework the horizontal portion of the penstock is supported by means of 48 iron rods, each one and one-half inch square.



JAMES LEFFEL & COMPANY'S "NIAGARA" TYPE WATER-WHEEL.

The "Niagara" type water-wheel consists of a large, flattened, vertical, circular casing, containing the guide case of the wheel proper. It is into this exterior wheel casing that the water is admitted from the supply pipes underneath, flowing upward and surrounding the guide case, being admitted to the runner through a series of oscillating guides, which constitute also the gates. From the sides of this casing project the discharge pipes, laterally and then downward by a gradual curve, to which draft tubes 20 feet in length are attached, thus utilizing in part the atmospheric pressure. The heads of the large casing are of curved form and shape to secure strength. They are made of cast-iron, three and one-half inches thick, and a circular band of steel plates three-quarters of an inch thick, double riveted to the cast heads, constitutes the straight or cylindrical portion of the case. It is within this casing and the guide casing that the runner or wheel proper is located upon a horizontal shaft, supported by adjustable ball and socket oil bearing, upon heavy arched iron bridge-trees exterior to the outer casing. The runners of the wheels are 74 inches in diameter, and made of bronze and iron, very substantially built.

The shell comprising the buckets proper, which receive the water by a sharp dividing diaphragm or ridge, is made of bronze, the central portion, upon which the shell is rigidly fastened, being of iron. The wheels discharge the water laterally into the receiving or discharge pipes, and owing to the peculiarity of the design there is no uncompensated pressure upon any part of the wheel, and, therefore, no end thrust or pressure endwise on the shaft, but the whole is perfectly balanced wherever it comes in contact with the water. The gates are operated by a double ring arrangement which is easily within the control of a hand-wheel operated by one person. To the hand-wheel shaft the automatic mechanical governor is readily attached, and in this plant the Lombard governor, made by the Lombard Water-Wheel Governor Company, of Boston, is in use. The head of water under which the wheels operate is 210 feet.

Boston Subway Lease Ratified.

The stockholders of the West End Street Railway Company, at a meeting on December 15, ratified the lease by the road of the subway now being constructed by the Boston Transit Commission. The total vote cast was 115,705 shares. Of these, 115,585 voted in favor of the lease and 120 voted against it.

Mr. S. Marsh Young, president of the Manhattan General Construction Company, of New York city, is in Europe and will return about the middle of January.

The American Institute of Electrical Engineers Discusses the X Ray.

A LARGE NUMBER OF MEMBERS PRESENT AT AN INTERESTING MEETING.

The American Institute of Electrical Engineers held its 110th meeting at 12 West Thirty-first street, New York city, on Wednesday evening, December 16. President Louis Duncan occupied the chair and about 100 members and guests were present to listen to a discussion of "The X Ray and its Relation to Physics."

President Duncan called upon Prof. Henry A. Rowland, of Johns Hopkins University, to open the discussion. Professor Rowland began his remarks by the consideration of the source of the X rays in a Crookes tube. He said that he had secured X rays from the anode and had made good photographs in this manner. By means of delicate measurements of the shadow cast by the ray, he had been able to define one source of the ray which was $\frac{1}{1000}$ of an inch in diameter. Professor Rowland also spoke of J. J. Thomson's experiments on the effect of the X ray on gases. Passing the X ray through a gas made it a conductor of electricity, so that a certain amount of gas would transmit a certain amount of electricity. Professor Rowland also asked the question as to whether the X rays were homogeneous, like light, and answered it himself by saying that it seems they are not. He also said that if the X rays are waves at all they must have a very short wave length.

Prof. Elihu Thomson was called upon to follow Professor Rowland in the discussion. He spoke of his experiments upon himself in relation to the sunburn effect of X rays, and exhibited the little finger of his left hand, which he had exposed to the rays for one-half hour as an experiment. For nine days no apparent effect was visible or felt, and then the finger began to show the sunburn effect and finally ulcerated. It had been six weeks and a half in recovering its normal state, and Professor Thomson remarked that he was thoroughly convinced that the X rays did have an effect on the human tissues. Professor Thomson also referred, in other interesting remarks, to experiments he had made on the penetrating effects of X rays on wrought-iron plates.

Prof. M. I. Pupin, of Columbia College, considered the X ray in relation to the Helmholtzian theory of light, and went into a long and very interesting discussion of the question. Dr. A. E. Kennelly mentioned a recent experiment which he had performed with the X ray, and exhibited a photographic negative showing a very minute particle of glass imbedded in human tissue, which had been detected by the X ray. Mr. Max Osterberg considered the question of energy supplied to the Crookes tube for the generation of the X ray. Professor Rowland closed the discussion with a few brief remarks, and the meeting closed with the reading of a communication from Prof. W. M. Stine, of Chicago, on "The Generation of the Roentgen Ray."

At the meeting of the executive committee in the afternoon the following associate members were elected: Chas. Hamen Adae, X-ray laboratory, P. O. box 2809; residence, 36 West Thirty-fifth street, New York city; William W. Blunt, electrical engineer, Westinghouse Electric and Manufacturing Company, Limited, 32 Victoria street, London, Eng.; Robert A. Byrns, 98 Ferry street, Lafayette, Ind.; John Jay Crain, electrician's helper, Niagara Falls Power Company, Niagara Falls, N. Y.; Henry H. Humphrey, consulting electrical engineer, Bryan & Humphrey, Times Building, St. Louis, Mo.; Dr. Erasmus Kittler, Elektrotechnisches Institute, Darmstadt, Germany; Harry Milton Latham, member of engineering staff, Crocker-Wheeler Electric Company, Ampere, N. J.; Robert Stuart Stewart, superintendent of lines, Public Lighting Commission, 440 Jefferson avenue, Detroit, Mich.; Frank Sutton, consulting engineer, 27 Thames street, New York city.

The following associate members were transferred to full membership: O. P. Loomis, electrical engineer, Bound Brook, N. J.; A. M. Schoen, electrician, Southeastern Tariff Association, Atlanta, Ga.; H. G. Field, consulting electrical engineer, Detroit, Mich.; S. G. McMeen, engineer, Central Union Telephone Company, Chicago, Ill.; J. W. McCrosky, electrical engineer, La Capital Tramway Company, Buenos Ayres; S. B. Fortenbaugh, assistant professor of electrical engineering, University of Wisconsin, Madison, Wis.; Lee Hamilton Parker, assistant engineer, railway department General Electric Company, Schenectady, N. Y.; H. M. Brinckerhoff, electrical engineer, Metropolitan West Side Elevated Railroad, Chicago, Ill.

REMINISCENCES OF EDISON—HIS QUADRUPLEX.

BY WALTER P. PHILLIPS.

One day I was asked if I were willing to come around in the daytime and work extra at the usual rate of compensation, and, replying in the affirmative, I was told to report in the electrician's room at noon until further notice. Seven other operators were selected, and together we experimented with Edison's instrument, which we were told was "the quadruplex." It was then in a very crude state, and the signals came over it in a way to suggest to an imaginative person the famous rocky road to Dublin. Edison was always present, changing something here or there, and gradually a result, somewhat imperfect but constantly improving, rewarded his efforts. Finally, he made us a little speech, saying: "Boys, she is a go. The principle is all right, and the sharps upstairs can get the bugs out of it. We can not do it down here, for the troubles with telegraphic appliances can only be gotten out in the same way the Irish pilot found the rocks in the harbor—with the bottom of his ship. There is nothing so baffling as the perversity of a new thing; it must be used in order to find out where the bugs are, and when they are located anybody can get them out." A "bug" is simply the elusive trouble that appears on wires and instruments, and which has to be found and eliminated before perfect results can be obtained.

When Edison stopped speaking, no one replied. We enjoyed hearing him talk, and were anxious to have him go on; but he only smiled, and then said abruptly: "You don't seem to tumble. Every man Jack of you is fired after to-day."

And thus the quadruplex, long since perfected, not wholly by Edison, but worked out on his lines by others, came into being; and, as many of you know, it is as much a part of the vast telegraphic machinery in use to-day as are the more simple and ordinary instruments.

Mr. Orton, who was then the president of the Western Union, was very slow in reaching a decision about purchasing the patent, and a little further down the street there was an unobtrusive-looking person who in his lifetime used to stray up and down Broadway without one in a thousand recognizing him or dreaming who he was. He was largely interested in the Atlantic & Pacific Telegraph Company. This quiet person, however, had not only heard considerable about the practical value of Edison's invention from his managers, but on his own accunt he possessed a somewhat keen eye, an intellect, on the whole, quite up to ordinary standards, and he had more decision of character and more courage than all the people then in the ownership of the Western Union Company. This man is dead now, but it was my good fortune to know him quite well, and it is due to his memory to say that a more modest, self-effacing, low-voiced and charming man could scarcely be imagined. His ame is familiar. I am speaking of the late Jay Gould.

One day when Edison had received several small payments on account of his invention, and when he needed money and was urging a final settlement with the Western Union Company without making any progress, he met Mr. Gould on the street, and the latter said:

"Tom, those fellows will never do any business with you. Why not sell the quadruplex to me? I'll buy it, subject to all litigation."

"What will you pay for it?" asked Edison.

"Well," said Mr. Gould, fumbling in his vest pocket, "I have here a check that was given to me an hour ago by Jarrett & Palmer, to whom I have sold the steamer 'Plymouth Rock.' It is for $30,000. I'll give you that."

The offer was promptly accepted, and Mr. Gould dropped in at the nearest place where pen and ink were available, and indorsed the check over to Edison. Then the litigation began, and lawyers and experts had most interesting sessions for a long time. Edison testified, and he told the court so many things that were new and strange that gray-haired judges and technical lawyers listened with one accord, and the question at issue was lost sight of in the entertainment his listeners found in having the coming wizard talk about abstruse subjects concerning which he knew so much that a mere knowledge of a common thing like the law made counsel and judges seem sadly ignorant in his presence.

Industrial Possibilities of the Electric Furnace.

[*From the Engineering and Mining Journal.*]

Researches in electric furnace work have already proved that all refractory substances, such as lime and magnesia and the least fusible metals, may be melted and volatilized by its means, and that only certain compounds of carbon, silicon and boron—which can themselves be formed only at the extraordinary temperatures of the electric furnace—are capable of holding their forms under its intense heat. The work done with this furnace has been so far experimental and in the laboratory, but it may be capable of some important developments in an industrial direction hereafter.

Motion Without Progress.

[*From Advertising Experience, Chicago.*]

"A man who keeps putting off advertising until business is better is like a dog trying to catch his own tail. There is plenty of motion but no progress."

TORONTO, ONT.—The Toronto and Suburban Street Railway Company have been granted an extension of time until July 1 next, to complete their line to Islington. It is anticipated that a new power-house will be erected at that point.

OUR CANADIAN LETTER.

VICTORIAVILLE, QUE.—This town is preparing to install an electric light plant in the very near future.

HALIFAX, N. S.—There is an agitation on foot to place all telephone and electric light wires underground.

MEGOG, QUE.—Mr. F. E. Lovell, of Lovell & Sons, was in town last week conferring with the councillors regarding the possibility of lighting the town by electricity.

MIDWAY, B. C.—Incorporation will be sought by the Cascade Water-Power and Light Company, for the purpose of supplying light, water and power to Midway, Anaconda, Greenwood, Grand Forks and Cascade City.

MONTREAL, QUE.—The meeting of the Standard Light and Power Company, Limited, was held on November 27. Mr. W. McLew Walbank was elected president and J. H. Burland was elected vice-president. Mr. N. S. Evans was elected to replace a retired director.

OTTAWA, ONT.—Application will be made for corporation of a company to construct a railway from a point at or near Mabigoon, Ont., to the mining camps. The projectors are Toronto capitalists, who propose to utilize water power to generate electricity. The road will be 75 miles long.

TORONTO, ONT.—The Toronto Street Railway gross earnings for the month of November were $74,617, as against $77,602 for the same month last year, showing an actual decrease of $3,365. But there was one working day less last month, so that makes a comparative decrease of only 381.

OTTAWA, ONT. — Letters-patent have been issued incorporating the St. Jerome Power and Light Company, Limited. Capital, $30,000. Amongst the charter members are Chas. S. Higgins, manufacturer; J. John Westgate, manufacturer, and John Simpson, merchant, all of Montreal.

CORNWALL, ONT.—The Cornwall Electric Street Railway have extended their line to the paper mill, a mile west of the town. The company will now take off the Water street cars for the Winter months, excepting during the hours the operators of the mill go and come from work, and will run one car from the paper mill to McConnell's Hill, at the east end of Lorenville, a distance of nearly three miles from one terminus to the other. The company's service for the past season has been better than was ever hoped for.

MONTREAL, QUE.—The earnings of the Montreal Street Railway for the month just closed amounted to $100,818.57, while for the corresponding month, 1895, the total was $93,484.21, an increase of $6,334.33. The average daily earnings for the past month was $3,360.62, and the average daily increase was $244.49. There were only five days in the month that the earnings showed a decrease as compared with 1895. Four of these days were Sunday, and the fifth was Thanksgiving Day, when the decrease was only $18.26. J. A. C.

Montreal, December 6.

ELECTRIC LIGHT FLASHES.

A bill has been introduced in the House at Washington appropriating $201,000 for the Marion Soldiers' Home. This measure included $17,500 for improvements and additions, among which are a new lodge and an electric lighting system, the latter costing $10,000.

The Spanish-American Light and Power Company, whose office is in New York and plants in Cuba, and whose capital is $4,000,000, has defaulted on its bond interest. Earnings before the war aggregated $1,000,000 a year. The city of Havana owes it $300,000. A receiver has been appointed.

At the annual meeting of the stockholders of the Edison Electric Company of York, Pa., the following officers were elected: H. H. Weber, secretary; C. C. Frick, treasurer. The directors for the ensuing year are Geoffrey P. Yost, C. A. Eisenhart, A. F. Geesey, E. T. Moul, W. F. Bay Stewart, B. S. Gilbert, H. D. Wiest.

The city engineer of Des Moines, Iowa, has prepared and filed with the council an estimate of the cost of establishing an electric light plant, to be owned and operated by the city, for furnishing the public lighting by arc lights, of which over 300 are to be used in the city. The cost of the proposed plants is estimated at $200,000 to $520,000.

The annual meeting of the Electric Light and Power Company, of Conshohocken, Pa., was held recently. The following directors were elected: H. C. Jones, H. M. Tracey, F. H. Lubbe, William Perot, Frederick Light, R. H. Bates and Harry Martin. The board organized by electing H. M. Tracey president and H. C. Jones secretary and treasurer.

H. R. Wagar, president of the Ionia, Mich., Electric Light Company, petitioned the Common Council for the extension of five years or more of the electric light contract now pending between the company and the city. Mr. Wagar contemplates the building of a dam across the Grand River east of Lyons, and obtaining water power sufficient to furnish the city with 500 horse-power at a much lower expense than by the present use of steam; also running 24 instead of 12 hours daily. The expense will be about $30,000.

A telegram from Santa Cruz, Cal., announces important improvements and enlargement of the plant of the Big Creek Power Company, which is supplying electricity to Santa Cruz. The additions to the plant embrace new generators, motors, water-wheels and impounding reservoirs to hold 5,000,000 gallons of water, and 52 miles of wire. As soon as the enlargement is complete the power company will have electricity to supply the railway system of Santa Cruz. It is expected that the Big Creek Power Company will eventually be able to send electricity by wire to San Jose, the distance not being much farther from the plant than Santa Cruz.

Electric Railways.

It is reported that the capital of the Metropolitan Street Railway Company, of New York city, is to be increased to $50,000,000, in order that funds may be provided for the change in power.

Plans have been prepared by the North Shore Railroad in Pennsylvania for a new electric railway from the city of Beaver Falls to Rochester and up the Ohio River to Conway. Estimated to cost $50,000.

The returns made by the Leominster, Mass., & Clinton Street Railway Company for the year ending September 30, 1896, show that the gross income was $25,233; operating expenses, $17,432; net income, $7,801; capital, $149,300.

The jury in the case of Thomas O'Donnell, who sued the Oakland, Cal., San Leandro & Haywards Electric Railway Company for $30,000 damages for the death of his son, caused by being run over by one of the company's cars, awarded the plaintiff $15,000.

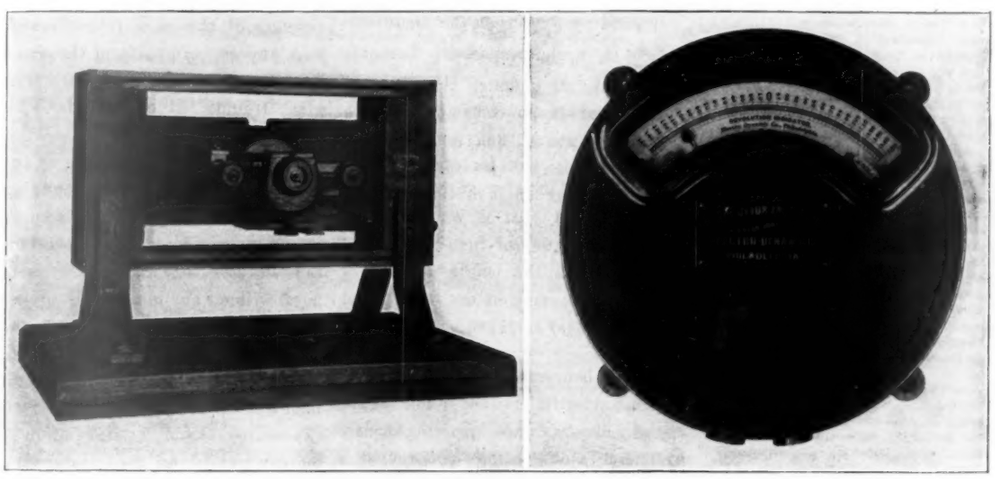
Proceeds of new stock and bonds to be issued by the Newton, Mass., Street Railway Company will be used for Nonantum and Concord avenue extensions and new equipment and improvements at Newton in way of grade crossings. Grades will, when completed, cost the street railway people about $50,000.

The Lowell, Mass., & Suburban Railroad Company is just now engaged in making extensive improvements and additions to its power plant at the power-house in Middlesex Village. The most important improvement will be the addition of a new 2,500-horse-power engine and generator and a full set of boilers to provide steam for the same.

It is said that the West End Street Railway, of Boston, Mass., will have the franchise of the subway February next, and will have its cars running through all that portion of the subway south of Park street to the two southern terminals at Church and Pleasant streets by the middle of March. Total cost of subway to date is $2,350,000.

The big power-house of the Chicago City Railway Company, of Chicago, Ill., at Forty-ninth street and Oakley avenue is now in operation. It is the largest single street railway power plant in the world, and when completed will furnish the south side lines with over 12,000 horse-power, and cost $650,000. The first pair of engines and generators will be set to work in a few days.

President C. P. Clark, of the New York, New Haven & Hartford Railroad, has confirmed the report that the Consolidated will take steps to equip its short lines in the vicinity of Hartford with electricity, using the third-rail system. The move is taken in order to meet the competition of the electric roads, and it is believed that, when the improvements on the Boston & Albany through the New-



An Electric Revolution Indicator.

tons are completed, electricity will be used on the suburban trains there.

The Minneapolis, Minn., Street Railway Company has contracted for the power to be furnished by the Pillsbury-Washburn dam, now being constructed in the Mississippi. The new plant will have 10,000 horse-power for sale, and the street railway company can use it all to good advantage. Of this, 5,000 will be used in Minneapolis directly, while the St. Paul end will have the power transmitted on alternating currents at high figures, which will be stepped down to 5,000 direct for use in the Saintly City.

At the annual meeting of Union Traction Company, Philadelphia, Pa., the report, covering the operation of the company for nine months, shows: Net receipts, $2,130,748; fixed charges, $2,180,042; deficit, $49,293. The management has provided a fund to cover a considerable portion of the company's fire insurance; $250,000 of its capital was set apart for that purpose, and two and one-half per cent of its gross receipts has been set aside to cover accidents. The total receipts were $11,865,978, and expenditures, $10,465,529.

An ordinance calling for a four-cent fare on all the street-car lines in Chicago, Ill., has been passed by the City Council. The vote was overwhelmingly in favor of the ordinance. It now remains for the Mayor to attach his signature, which must be done within 10 days. In case of the Mayor's veto, it is said the ordinance will be passed over it by the council. There were many who favored a three-cent fare. The street-car companies, it is said, will fight the ordinance, and it is probable that in case it becomes a law the matter will be taken into the courts.

The Pleasant Valley, Pa., Railroad Company is contemplating heating its 130 cars by means of electricity this Winter. Engineer Hubbard, of the company, is now experimenting on an electric process, by which the cars can be heated. It is said to be almost perfect. By the new arrangement the heat in the cars can be regulated to any degree. On cold days an excessive heat can be generated, and on warmer days the heat can be moderated to suit the climate.

As soon as the electric heating has been approved by the company, it will be adopted.

A Revolution Indicator.

The Electro-Dynamic Company, of Philadelphia, have lately placed on the market a revolution indicator involving principles entirely different from any instrument of the kind yet introduced. A revolution indicator differs altogether from a revolution counter, owing to the fact that it shows, by means of the pointer on a dial, the actual rate of speed at any moment, instead of simply counting the number of revolutions in a certain time.

The working of this machine (illustrations of which are here shown) is electrical, and based upon the fact that the voltage generated by an armature revolving in a constant magnetic field is proportional to the speed; therefore the voltage can be made an index of the number of revolutions made by any revolving shafting or machinery, and a voltmeter graduated in revolutions instead of volts can be made to show at any moment the speed at which the generator is revolving.

Fig. 1 shows the generator, which is a magneto machine, differing from a dynamo, owing to the fact that it has permanent magnets for the fields, instead of magnets excited by itself. This machine is belted to the engine or other shaft whose speed is to be indicated, and from it wires lead to the indicator dial shown in Fig. 2, which is a simple voltmeter, graduated to read revolutions instead of volts.

The field must be of constant strength, in order that the voltage produced may be proportional to the speed. To accomplish this the magnets are manufactured of a special grade of steel, which is said to be the only one known having the requisite property.

The armature is of the iron-clad type, which adds greatly to its efficiency as a keeper, and so assists in preventing any deterioration in the strength of the magnetic field. Should any variation in magnetism occur, means of regulating the machines are provided by an adjustable shunt in the air gap. The dial indicators are also capable of adjustment and correction, both for zero and amount of deflection. These adjustments are simple matters, based on comparing the readings of the indicator with those of an ordinary revolution counter.

An important feature of this apparatus not shown by any mechanical indicator is that any number of dials may be connected to the same generator, and be placed in widely separated locations. For example, in a manufacturing establishment or mill, dials may be put in the superintendent's office, the engine-room or wherever desired.

In its application to marine engines this indicator has filled a "long-felt want"; in fact, the apparatus here shown is intended for this class of work, as not only does it show the number of revolutions, but also the direction of turning; for should the generator be reversed, the direction of the current will be reversed also, and at once shown on the dial by the pointer moving to the opposite end of the scale. In marine use it is customary to have dials in the chief engineer's room and on the bridge of the vessel.

One of the effects of the apparatus in marine work is to enable the two engines of a twin-screw ship to be kept as nearly as possible at the desired speed. This enables the rudder to be kept amidships on a straight course, avoiding the drag due to its being kept at an angle. One of the Atlantic greyhounds claims to save over two hours in a trip as a result of being able to regulate the engines and keep the rudder central.

This apparatus is installed on the ships of the American line, some of the new ships of the navy, several yachts and other steam vessels.

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Special Notice to Advertisers.

CHANGES for advertisements must be in this office by Friday noon for the following week's issue.

NEW ADVERTISEMENTS should be in the office not later than Saturday noon to insure publication the following week.

NEW YORK, DEC. 23, 1896.

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The Metropolitan Street Railway Company is really advancing. Its car horses are all to disappear from the streets of New York. We congratulate the company, and particularly President Vreeland and Vice-President and General Manager Littell, that at last this great street railway company will be run on parallel lines of improvement with Hohokus, N. J., and Kalamazoo, Mich.

The electrical field will be an unusually active one during 1897. Every sign indicates it. The wise manufacturer is looking ahead and preparing for it. From the information that comes to the ELECTRICAL REVIEW office, we are convinced that there will be large additions to the established electric lighting plants, as well as many new installations, and a vast increase in electric railway interests.

A recent consular report gives some interesting figures on the manufacture of incandescent lamp filaments in Paris. It is stated that filament for 20-candle-power lamps is worth $8,000 a pound, and for 30-candle-power lamps, $12,000 a pound. The filaments for lamps of three candles are so light that it would require nearly 1,500,000 of them to weigh a pound. As the length of each of them is 10 centimeters, their total length would be 187 miles.

The competition between interurban electric railways and steam railroads is constantly growing keener. There is now being constructed a trolley road between Milwaukee and Chicago, which will undoubtedly prove a competitor of the steam road between those cities for passenger traffic. The steam road apparently realizes this fact, and is seeking to retard the electric railway work by injunctions for various reasons. The electric road has been completed from Racine to South Milwaukee, where it connects with the system of the Milwaukee Electric Railway and Light Company. Another road is being built out from Chicago to connect with the Racine road. The completed electric line will tap all suburbs between Chicago and Milwaukee. The New York, New Haven & Hartford Railroad was the first steam road to recognize the trolley as a competitor, and at once began to meet this competition by installing an electric system of its own. Other steam roads have followed suit and many more will doubtless do the same thing. For suburban traffic no other power can successfully compare with electricity.

HIGH-SPEED ELEVATORS.

A correspondent of the New York *Sun* objects to the "scorching" indulged in by elevators in the high office buildings, and suggests that a law should be passed regulating the speed of these elevators and requiring that a skilled "electric or other engineer" be in charge of each car. It is very true that the speeds of many elevators in the larger cities are far beyond what they were a few years ago and probably have approached very near the danger limit. The electric elevator has made great progress in the last year or two and is now a successful competitor of all other types. Most of the electric elevators on the market are the result of years of experimenting on the part of experienced electrical engineers, and every detail has been designed with the idea of operating each car by means of unskilled help. The method of operating the electric elevator is so simple, as far as the running of the cars is concerned, that any one can perform the small amount of work required. The great trouble, to our minds, with the high-speed elevators is the class of employés placed in charge of the cars. In one large office building in New York city where a number of serious accidents have occurred, the elevator attendants are mere boys, without any idea of the proper way to do their work or of the responsibility which rests upon them. It would seem that a syndicate of men who can erect one of the modern sky-scrapers could certainly afford to employ men to run the elevator cars, which are, after all, the most important part of the engineering plant of such buildings.

The Chicago police have very properly refused to allow an exhibition in that city which would have been brutal and degrading. "Tip," a dangerous elephant, which had killed several keepers, was condemned to death by its owner, a circus proprietor. He proposed to kill the elephant by electrocution, and asked permission of the authorities to make the affair an exhibition, to which an admission was to be charged. The city authorities refused to grant the desired permission.

What an interesting and important contribution to progressive science has been the part of the electrical industrians during 1896! And it is safe to expect a great deal more during the year just beginning from the earnest men devoted to the development of this extending field.

Street Railways and Electric Lighting.

Recent developments seem to indicate a growing affinity between our street railways and the electric lighting business, says the *Commercial and Financial Chronicle.* In several important cities the two interests have recently been united. We have thought it desirable, therefore, to ascertain precisely how far the process of consolidation has gone the country over, and to determine the reasons upon which it is based.

We would not by this imply that for a street railway to be engaged in the electric lighting business is anything entirely new. Instances of the kind appeared in the early history of the trolley road, as at Richmond, Va., and at Milwaukee, Wis. But hitherto this union has been principally in places of small population. In the cities the field afforded was sufficiently large to make profitable separate companies devoted to the two lines of business. The lighting company was usually the first to get established, and during the earlier stages in their career the trolley road and its sister, the electric lighting company, had their hands too full, each with its own business, to pay much attention to the other. In the meantime the shares representing their capital stocks were so widely distributed in the hands of investors that subsequent consolidation was no easy task.

A point seems now, however, to have been reached where the advantages to be obtained by consolidation are overcoming the difficulties and bringing the consolidation about. We cite the case of the Toledo Traction Company, of Toledo, Ohio. This company has acquired all the properties, rights and franchises of all the street railways in Toledo, and it also controls, by ownership of the entire capital stock and bonds, the Toledo Consolidated Electric Company, which last owns and controls practically all the electric lighting and power business of the city and the underground conduits. Its entire system—railway, incandescent and arc lighting and power—will, we are informed, be operated from one new central power station in place of from four stations, as heretofore.

Two years ago the Terre Haute Electric Railway Company, of Terre Haute, Ind., secured the contract through the Citizens' Electric Light and Power Company, which it owns and operates, for lighting the entire city by electricity. The same company owns the Steam Heating and Power Company, and in 1895 began using its exhaust steam for heating purposes. At Augusta, Ga., recently the Augusta Railway, the Augusta Light Company and the Thomson-Houston company were consolidated as the Augusta Railway and Electric Company, which thus secures control of the electric business of the entire city. At Zanesville, Ohio, and at Akron, Ohio, within a few months, similar consolidations having the same end in view have been effected.

In the following table we have brought together the names of 39 street railway companies owning or controlling electric light plants.

COMPANIES OWNING ELECTRIC LIGHT PLANTS IN FEE OR BY STOCK.

Names of companies: Akron, Ohio, Street Railway and Illuminating Co.; Allentown, Pa., & Lehigh Valley Traction Co.; Alton, Ill., Railway and Illuminating Co.; Amsterdam, N. Y., Street Railway Co.; Ashland, Wis., Light, Power and Street Railway Co.; Atchison, Kas., Railway, Light and Power Co.; Augusta, Ga., Railway and Electric Co.; Beatrice, Neb., Electric Co. Canandaigua, N. Y., Electric Light and Railroad Co.; Columbia, S. C., Electric Street Railway and Power Co.; Cortland, N. Y., & Homer Traction Co.; Danville, Ill., Gas, Electric Light and Street Railway Co.; Dunkirk, N. Y., & Fredonia Railroad Co.; Helena, Mont., Power and Light Co.; Ironwood, Mich., Twin City General Electric Co.; Ithaca, N. Y., Street Railway Co.; Knoxville, Tenn., Street Railroad Co.; Long Branch, N. J., Atlantic Coast Electric Co.; Long Island City, N. Y., New York & Queens County Railway Co.; Marshalltown, Iowa, Light, Power and Railway Co.; Menominee, Mich., Electric Light, Railway and Power Co.; Michigan City, Ind., Lake Cities Electric Railway Co.; Milwaukee, Wis., Electric Railway and Light Co.; Mobile, Ala., Light and Railway Co.; Muscatine, Iowa, Electric Railway Co.; Negaunee, Mich., & Ishpeming Street Railway and Electric Co.; New Britain, Ct., Central Railway and Electric Co.; Ottumwa, Iowa, Electric Railway Co.; Richmond, Va., Railway and Electric Co.; Sacramento, Cal., Electric, Gas and Railway Co ; St. Joseph, Mo., Railway, Light, Heat and Power Co.; Schenectady, N. Y., Railway Co.; Terre Haute, Ind., Electric Railway Co.; Toledo, Ohio, Traction Co.; Waterbury, Ct., Traction Co.; Waterville, Me., & Fairfield Railway Co.; Wichita, Kas., Electric Railway and Light Co.; Winston-Salem, N. C., Railway and Electric Co.; Zanesville, Ohio, Railway and Electric Co.

The reasons for this consolidation process are not hard to find, being principally, as all realize, the expectation of a considerable saving in expenses by the concentration of management and the economizing of power. But another object sought is to transform the relatively small local enterprises into single corporations having capital and stability enough to command the respect of investors and banking interests. The rapid growth of our American cities renders attractive to investors the securities of corporations that possess special privileges or facilities for catering to a community as a whole; and the combination of the electric lighting business with the street railway service must tend to make the field still more inviting. It is a mistake to assume that the existence of a single large corporation of this kind in a municipality is likely to be inimical to the public interest. Under an enlightened policy by the city and the corporation it should prove reciprocally beneficial. On the other hand, as experience has plainly shown, the doing of any electric lighting business will not save a street railway from bankruptcy if the capitalization assumed is too weighty or other conditions are unfavorable. As the investment demand for corporate securities expands, we expect to see more and more cases where street railways and electric companies are united, either absolutely or practically, through the ownership by one of them of the other's securities.

PERSONAL.

Mr. G. A. Mansfield, treasurer of the Michigan Electric Company, of Detroit, was a recent visitor to New York city.

Mr. Geo. A. Redman, the well known electric light man, of Rochester, N. Y., visited New York early this week.

Mr. Cyrus O. Baker, Jr., the platinum refiner of New York, visited the city of Boston last week in the interest of his house, Baker & Company.

Mr. H. A. Clark, formerly electrician and engineer of the Denison University electric plant at Granville, Ohio, is now electrician for the Addyston Pipe and Steel Company at Addyston, Ohio.

Maj. W. Lyman Candee has returned from a delightful vacation of two weeks in the great city of Chicago, where he learned incidentally of the many compliments his insulated wire was winning in the West.

General Superintendent John C. Reilly and Engineer Lane, of the New York & New Jersey Telephone Company, spent a portion of last week in Boston discussing telephone engineering problems with technical officials of the American Bell Company.

Mr. Frank Ridlon's pleasant countenance comes to us included in a very excellent photograph of his extensive Boston shops. It has been a long time since Mr. Ridlon has visited New York, and his presence now, even by photographic proxy, is greatly appreciated.

Gen. Thomas Sherwin, president of the New England Telephone and Telegraph Company, Boston, was a New York visitor Friday of last week. Under the wise and efficient management of General Sherwin and General Manager Keller this company has rapidly gained in the number and extent of its patrons and improved service.

The Metropolitan Street Railway Company.

The improvement decided upon by this great New York traction company is to be rapidly pushed to completion. As before announced, a change from horse-power to electric power has been decided upon on the Fourth, Sixth and Eighth avenues.

The track rails for this big work have been contracted for with the Cambria Iron Company and the switch rails are to be supplied by Wm. Wharton, Jr., & Company; both Philadelphia companies. The electrical part of the contract for refitting the lines will, it is understood, be given almost entirely to the General Electric Company. Another important meeting of the directors of the Metropolitan Company is to be held this week.

Death of Harvey L. Lufkin.

Harvey Lamb Lufkin, general manager of the Crocker-Wheeler Electric Company, died at Mt. Sinai Hospital, New York city, at 9 A. M., December 21, of appendicitis. He was taken ill last Thursday morning, a few days after his return from a two months' trip to the Pacific coast, and was at once removed to the hospital, where the usual operation for appendicitis was performed. The disease had progressed to such an extent that, although strong hopes were entertained of his recovery as late as Saturday last, Mr. Lufkin gradually sank until the end.

Mr. Lufkin was born in Cleveland, Ohio, in 1857, and had been engaged in electrical work for the last 15 years. As early as 1886 he was associated with Messrs. Crocker and Wheeler in the old C. & C. company. Since 1892 he had been connected with the Crocker-Wheeler Electric Company.

Mr. Lufkin was one of the few electrical engineers who had continuously devoted his energy and ability to the development of electric power since the advent of the electric motor in commercial form. He did a large amount of original work and had installed some of the most important power plants in the country.

Mr. Lufkin was an associate member of the American Institute of Electrical Engineers and was prominently connected with the Electrical Exposition in New York city last May. He leaves a widow, but no children.

A Good Pointer on Electric Mining Machinery.

If manufacturers of mining machinery, and electrical appliances in particular, would keep a close and accurate record of the cost of maintenance and efficiency, as well as of the first cost, of their machines in actual operation, they would be in much better condition to meet prospective customers, says the *Engineering and Mining Journal.* If one mine owner visits his neighbor who has a new piece of machinery and makes inquiry relative to the same, he is nearly always misled. The mine operator who has a good thing wishes to keep it to himself. Mine owners and operators will invariably refuse to give this information to their competitors, or if they do give information it will be misleading. Manufacturers could secure this information very easily, as a record is kept of every piece of machinery in all well organized mines, and they would thus be in a position to give the information to an intending purchaser.

Patent Alliance of the Phonograph and Graphophone Interests.

The Edison Phonograph Works, manufacturers, and the National Phonograph Company, owners of the Edison patents, have reached an agreement with the Graphophone Company, by which all litigation will cease, an exchange of licenses will be made and proceedings taken against all outside companies. The above interests represented by the first two companies on one side and the Graphophone Company on the other have been in litigation since 1891.

ELECTRIC TRACTION UNDER STEAM RAILWAY CONDITIONS.

A TOPICAL DISCUSSION BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, NEW YORK, OCTOBER 21, 1896.

(*Continued from page 303.*)

Now, as to the question of efficiency. Our friend here has stated that only 45 per cent efficiency is obtained in regular work. We made a large number of tests, extending over a month, on the Lehigh Valley road, where we had opportunities, with a dynamometer car, and knowing the grade, to figure the lifting of the engine—lifting a train a certain distance into the air in a given time—where we got a horse-power for 20 pounds of water by the pull on the drawbar—20 pounds of water in a horse-power hour. The work done and the efficiency, as far as the friction of the engine—the difference between the friction of the engine and the indicated horse-power—would not amount to more than 10 per cent in that work, at a speed of about 30 miles an hour. Now, these are only pointers. I have not taken time to go into an elaborate paper. I simply give you a few facts, which I have dug out by hard knocks right on the locomotive myself. Now, as regards the question of speed, and also the question of the even pressure on the rail. I have lately built a locomotive which is so perfectly balanced that at a speed of 75 miles an hour you can read a newspaper in the cab. It rides as easily as a Pullman car, and the pressure is absolutely the same at every part of the revolution. That engine will do its work with the lowest grade of coal that you can buy in the market; it makes no smoke, throws no cinders and makes no sound from the exhaust. Now, it meets all the conditions, all the requirements, that an electric locomotive could meet. The only advantage that an electric locomotive would have over the ordinary locomotive would be that it would give an even pull on the drawbar, an even pressure on the rail and would not throw any sparks or make any smoke. Now, the engine I speak of can be duplicated any number of times for $12,000. She will give 2,000 indicated horse-power. She will take 12 Pullman cars from Philadelphia to Jersey City in 90 minutes. The same engine has taken, from Susquehanna to Hornellsville, an eight-car train, with eight stops and five slow-downs, at an average of 61½ miles an hour for the whole distance. When you undertake to beat that kind of work with an electric locomotive, you have got a big contract.

Mr. A. E. Kennelly: This question of applying electric traction to steam roads has been a fascinating subject to many of us for quite a few years, and I do not think the problem has changed very much in its character during the last five or six years, although its limitations become perhaps more clearly visible from year to year. The manifest success which has attended the introduction of electric street cars where comparatively low speeds are necessary, where frequent stops can be made very cheaply, where a car will stop at any person's door or at any street corner, has been so marked that it has been predicted that the electric locomotive would rapidly transplant and displace the steam locomotive. The conditions are, however, in this case so widely different that I do not think we can postulate, at first sight, any such conclusion. So soon as you get upon a reserved track, and have to make a high speed, you can not stop—you have not the time to stop—it costs too much to stop; then you meet the conditions which are found in existing long-distance steam roads to-day. For many years this problem of carrying passengers rapidly and comfortably over great distances has been dealt with by steam locomotive engineers, and the maximum economy has been long striven for that existing conditions will permit. It is contended that, if we could replace the steam locomotives of the present time by electric locomotives, we could economize—that we would show an economy by reason of the saving in fuel. Now, I never saw any engine that it was claimed would produce a horse-power on, say, two pounds of coal per indicated horse-power. I have always understood that it took five and six. I will assume that for the present time they do take five and six pounds of coal, on an average, throughout the country. The fuel expenses of the roads throughout the country are stated in the statistics to vary from seven per cent to 13 per cent of the total operating expenses, and we may take an average of, say, 10 per cent of the total operating expenses as covering the cost of the coal, and perhaps also the cost of the water supply. Assuming that we had some kind friend who would take a steam railroad and give us an electric locomotive to-morrow for each steam locomotive, having the same power and being worth about the same amount of money, and also providing the plant and conductors whereby that system could be operated, we should be able to throw out all the tenders, and that would be a considerable saving, no doubt. We should save 25 tons or so to every train, and that would enable us to haul a larger load of freight and carry, perhaps, a little higher speed with safety for passenger service. The difference in coal consumed might amount to as much as 12 per cent upon the passenger trains; it might amount to only three or four per cent on freight trains. But suppose it averaged about six per cent. We should have a saving of fuel of about six per cent simply by displacing the tenders. The steam plants situated in a central station might possibly, let us say, generate an indicated horse-power on two pounds of coal. I fancy that it would be safe to allow three to meet average conditions of variable loads. With three pounds of coal per horse-power hour at the central station for the transmission system, we should probably expect to develop a horse-power hour at the shafts of the electric locomotive for about five pounds of coal per indicated horse-power hour. We should, therefore, be very little better off than we are at the present time with good steam locomotives. Even if we succeed in bringing the coal consumption down to two pounds per one horse-power hour, we could not expect to develop a horse-power hour at the locomotive shafts for less than three and one-third pounds. We should, however, have a greatly increased plant, a much larger inspection and much greater fixed charges, and we could not, so far as I can see, expect, under the conditions of railroad traffic of to-day, to see any saving effected.

But the question, fortunately for us, does not lie solely in that compass. Economy is not the sole point of advantage in which we can expect to increase electric traction. If economy were the only factor of passenger transportation, we should never find that the passenger steamers which run across the Atlantic would increase their expenses every year by putting more and more horse power on board their ships, consuming coal approximately in proportion to the cube of the velocity, in order to carry their passengers over the ocean in a few hours less time. And if it can be demonstrated that an electric locomotive can safely carry passengers at, say, 100 or 120 miles per hour, I think there is a very large field open for the electric locomotive on the lines of high speed. It may cost more, but it is very probable that people would be ready to spend more for high-speed passenger service. The conditions at such speed would be so radically different, the problem presented would be so different, the number of cars per train and the character and style of the cars so different, that a new problem is presented, and on those lines I think there is a future for the electric motor. But on the lines of the present steam locomotive, and the mere substitution of electricity for steam, I do not see where we can claim an advantage. The schedule time which the steam railroad time tables of the last 20 years show us, does indicate an improvement in express train speed, but by no means a marked improvement. I think that it is a tacit admission to the effect that the steam locomotive can not commercially be made to run on existing railroads at very much higher speeds than that attained to-day. How far that may be due to imperfection in the locomotive as a machine, or how far to imperfections in existing track, is a more difficult question. But if, as we believe, an electric motor can be produced making up in lightness what it lacks in drawbar pull, and will haul light cars at a very high speed, then, I think, we may safely hope for a great future for the electric passenger long-distance railway. (Applause.)

Mr. C. F. Uebelacker: Aside from the matter of expense—not entirely aside from it, but rather a point which brings the question of electric traction away from the question of expense, more or less—is the ultimate capacity of the steam roads for freight traffic. As I have been thinking it over for the last few days, it seemed to me of a good deal more importance than we have been realizing. The fact is that three or four years ago, in 1892, when probably we had the heaviest traffic of any time on the steam roads, quite a number of them were operated on the verge of congestion. It was a strain all the time to keep the freight moving, and particularly to keep the fuel which runs our cars here in the East moving from the West. At that time some of the gas plants around this portion of the country were looking each day to see where their for the next day's coal was. When things get into that condition, it has come to a point where we have got to find some method of conveying our energy from the coal fields, if that is where we have got to get it from, to the point where it is consumed, in some more concrete form than by hauling fuel in cars. The actual fact is that on several of our roads the coal and coke carried amount to a little more than 50 per cent of the total freight tonnage. The removal of a portion of the tonnage would, of course, make room for more manufactured products. I think the feeling amongst all the railroads is that they do not want to spend any more money; they do not want to lay out the enormous investments which would be necessary for them to materially increase their carrying capacity. The terminal facilities particularly are pretty expensive—around the city of New York, for instance. I think it is getting narrowed down to a question of what form of transmission we will use in order to get energy from the coal fields (the main sources of power) to the point where manufactures concentrate. We have several before us. We have heard a good deal about compressed air in the last few months. I have been looking it up as carefully as I could, but I can not find very many data about it. As applied to street railroads, the best I have been able to find were in a letter of Mr. Ira Harris, written to *The Railroad Gazette*, along in October sometime. He concludes that air can be compressed at about six cents per 1,000 cubic feet of free air, and that it is going to take to run an ordinary street car about 417 cubic feet of free air per mile at the speed we ordinarily run. That looked to me very much like about two and one-half cents a car mile for power, and I do not think we are prepared to take power at that rate just at present. I think a fair average for electric work would be about one cent a mile. That is what it costs our road—a little under, perhaps. I think the conclusion, so far as compressed air is concerned, would be obvious under those conditions. We have the explosion motor of various kinds and descriptions, but there does not seem to have been enough progress made in that to tell what the outcome would be if it was put in large units. Probably the most promising thing is the gas motor, and the distribution of gas for power purposes through a piping system. The piping system is not a thing that we look on with very much favor as compared to a copper circuit—rather more trouble to keep in shape. If, then, we come down to the question of transmission of the energy to the manufacturing centers from the coal fields by electricity, it would naturally follow that the roads carrying the freight between those centers would adopt that power too, and it would come down more to a question of what variation we would have to make in our present practice to adapt that power to long hauls. The first thing that would strike us is that we could not very well go at it in the hammer-and-tongs manner that we do in electric railroading; that is, we can not put in power enough to start the whole road at once, if necessary. It is altogether too large a problem. The excess of power we would have to provide would run into too big a figure altogether, both the excess capacity of the line and the excess capacity in the power-house. The only way in which we can overcome that at present is by the use of the storage battery. Of course, the nearer we get to the point where the power is actually used, with the storage battery, the more we save in the capacity of the line and the station. Putting the battery on the locomotive itself, we save in the capacity of station and line both, and approximate very nearly the ideal line. At the same time, we cut down the enormous fluctuations which would result from the use of electric locomotives on a line where no such provision is made. Let us try to imagine once the conditions which would exist without such provision for fluctuations if we have, say, five or six switching engines in the yard moving around at once, and perhaps the Chicago Limited moving out and getting up speed as fast as possible, and four or five locals pulling out of the train sheds. It would take about 6,000 horse-power plant, and altogether it would make fluctuations from about 10 units that the load on that plant would be depending on. They would be accelerating, shutting off and accelerating again, continually. It strikes me that the ammeter would want to give up its job in disgust; in fact, an attempt to work with electric power under those conditions, I think, would be out of the question, and it comes down to the question of a suitable storage battery to be used on the locomotive. The storage battery is

more or less of a problem in itself, but the experiments upon the Third Avenue Elevated, I think, will demonstrate what can be done in that direction. The plan they are adopting there is, I believe, that of placing the storage battery on the locomotive, and that, I think, will be the solution when we come to require a solution of the question.

Mr. Elias E. Ries: I have listened with a great deal of interest to the discussion this evening. I came too late to hear the first part of Dr. Emery's paper, but it seems to me that this whole question of electrical traction under steam railroad conditions might be resolved into three divisions and be considered under three distinct and separate heads. First, we must consider the general question of feasibility, practicability and economy in substituting electric locomotives for steam locomotives, as such. That point, I think, has been already demonstrated.

We know that electric locomotives of very large size and power are practicable. The best evidence of that fact is that there are to-day in Baltimore electric locomotives of 95 tons weight which are hauling the heaviest kind of steam railroad trains, including the steam locomotives attached thereto, through the Baltimore & Ohio Railroad tunnel, day after day. They are, in fact, developing an amount of tractive power of which steam locomotives of the same weight are incapable; so that the question of feasibility of electric locomotion under even the severest steam railway conditions is definitely assured.

The question as to whether or not the substitution of electricity for steam is at present economical depends entirely upon the length and character of the railway, its location, and upon the nature of its traffic. We must, accordingly, before we give an answer to this question, classify these steam railroads, and proceed to consider their operating conditions under the two additional heads alluded to, the first relating to such conditions as are found, for example, on comparatively short interurban railroads, or, still better, on the New York elevated railways, where the trains move at close headway, where they are comparatively light, where the structure itself is reasonably short, being less than 10 miles in length, and where all the conditions approximate that ideal which electricians look upon as the best and most economical for a railway service in which the motive power is derived from fixed stations; that is to say, a system in which the train units are short, frequent, light, close together, and, in brief, a system in which the load is subdivided and, as nearly as practicable, distributed evenly and smoothly over the entire line. That condition, I think, is fulfilled very closely by the elevated railway systems of this city, and I believe, all things considered, that the substitution of electricity for steam locomotives ought to commence right here under such conditions as those. I am of the decided opinion that the arguments against the substitution of electric locomotion for steam on ordinary trunk lines, which have been brought out to-night by our steam railroad friends, would not apply to conditions of that kind.

Coming now to the third division or heading, which relates to and includes the long-distance or trunk-line roads, I may say that we are not at present, generally speaking, in a condition to compete commercially with the steam locomotive. Although speculations as to the ultimate use of electricity on long-distance steam railroads have been quite frequent, these have never as yet amounted to anything in a tangible way. The steam locomotive is admittedly quite inefficient as a power producer, using, as has been said to-night, from five to six pounds of coal per horse power developed, whereas by generating the power at properly equipped central stations, using large, efficient stationary dynamos and evenly loaded stationary compound-condensing engines and all the modern coal and labor-saving appliances, the energy can be produced at two, or a fraction over two, pounds of coal per horse-power, besides effecting a considerable saving in labor. The margin of saving in favor of the stationary plant is too great to be ignored, where it can be turned to useful account. Yet there are other features which render it impracticable, under present traffic conditions, to operate electrically even moderately long-distance steam railways. In the first place, the trains, instead of being reasonably frequent, close and light, are few, far between and excessively heavy. It has always been the aim of steam railroad managers, and not without reason, to crowd as much traffic as possible into as few trains as could be consistently run, with due deference to the cost of additional train service on the one hand and the clamor of the traveling and shipping public for increased facilities on the other; and so long as these conditions last, and the trains are made heavy enough and the schedules separated enough, the steam locomotive can undoubtedly do the work more economically. However, I do not believe that the limit of substitution of electricity for steam will have been reached when we equip a system like the elevated roads, or like a short surface road connecting two populous cities or towns and doing a very large and frequent local passenger traffic; but am firmly of the opinion that, with the development of higher transmitting electro-motive forces and more simple methods of conversion than those which are now practicable to use, we will be in a position to attack the problem of general electric locomotion on trunk-line roads. This will be the case more especially when we have learned how to build our road-beds and track, so as to permit of higher speeds with safety than are possible with steam locomotives. An electrically welded track, free from mechanical joints, of the present type, will go far to bring about this condition of perfection, and at the same time diminish the transmission losses due to artificial track bonding that now enter so largely into our calculations on line losses and copper cost. It is not so much a question of cost as of ultimate construction and operating conditions on these roads. The mere question of economy in coal, as has been fully pointed out this evening, does not enter so largely into the results to be obtained as to be the controlling factor. The consumption of coal alone is only a small fraction of the operating expenses of a road at best, and while saving in that respect is very desirable, yet the absence of it would not keep back the introduction of electricity if electricity can show decided advantages over the present method of operating by steam, either in speed, safety, frequency of train service, cleanliness, lessened proportion of dead load of locomotive and train to passengers, improved methods of lighting, heating and braking, enhanced facilities for handling and dispatching trains, general attractiveness to passengers, or in any other way.

Mr. Kennelly has well said that the transatlantic steamship companies have found high speeds to pay, even at the expense of the well known enormous disproportional increase in coal consumption. We can readily save one-half of the total coal consumed per hour by our modern transatlantic liners by running at a speed only a few knots less, or, if we desire to economize still further, we can dispense with coal altogether and cross the ocean under sail, as our grandfathers did before us.

If electric energy generated at power stations is ever to be applied to steam railroad work for long distances, it is, I believe, necessary that such a system will use high-tension alternating transmitting currents converted at points along the line of way into safe lower-tension operating currents either alternating or direct, preferably the former, and fed to the locomotives in this converted or lower-tension form.

The introduction of electricity upon steam railroads will bring about new traffic, operating and economic conditions that are now scarcely dreamt of, and upon these conditions its superiority and commercial success will depend.

(To be continued.)

An English Joke.

[*From the London Electrician.*]

The *Journal of Gas Lighting* recently referred to municipal authorities "who are inclined to think the trolley wire not so black as it is generally painted." We should be glad if our esteemed contemporary would oblige us with the names of places where the trolley wire is generally painted and how the practice works. This suggests a new rendering of a much-quoted quotation, which would read somewhat as follows: "As idle as a trolley wheel upon a painted wire." After our contemporary's attack, we hope it will not be necessary for electrical engineers to whitewash the trolley wire."

Electrical Man Charged With Forgery.

Charles N. Cunningham, president of the Warwick Electric Manufacturing Company, of Cleveland, Ohio, whose plant was recently sold at auction, was arrested at Cleveland on December 14 charged with forgery. He is accused of forging the name of Judge E. T. Hamilton to a check for $75,000. Cunningham's friends believe that his mind has become unbalanced over business troubles.

Wenstrom Electric Company.

The annual meeting of the stockholders of the Wenstrom Electric Company was held recently in Baltimore, Md., at the Hotel Rennert. The board of directors for the ensuing year was elected as follows: Messrs. G. M. Hutton, James A. Gary, Ferdinand C. Latrobe, Robert Rennert, Seymour Mandlebaum, Peter E. Tome and H. Marcus Dennison.

The Board of Gas and Electric Light Commissioners have given a decision in the petition of the Edison Electric Light Company of Springfield, Mass., for approval of an issue of $200,000 in bonds, $90,000 for construction and equipment of an auxiliary station at Indian Orchard and $110,000 for funding a part of the floating debt.

GENERAL NOTES.

The Edison Illuminating Company of Boston, Mass., has petitioned the Gas Commissioners for $600,000 stock for the extension of the company's plant.

The electric light system for Sidney, N. Y., is fast nearing completion. Water power will be used. The company are building foundations for water-wheels and dynamos.

Chicago contractors have secured the contract for the construction of 28 miles of electric road from Fort Wayne, Ind., to Wawasee Lake, Ind. They will receive $275,000 for the work.

The Edison Electric Illuminating Company of Brooklyn, N. Y., has declared a quarterly dividend of one and one-half per cent, payable January 15. Transfer books close December 31 and reopen January 11.

A press dispatch from Chicago, dated December 16, states that the Milwaukee Electric Railway and Light Company has absorbed the opposition Pabst Company, and reorganized as the Milwaukee Light, Heat and Traction Company. This gives it all the city lighting, as well as the surface railways. About $500,000 was paid for the Pabst Company.

The Scranton, Pa., Traction Company reports gross earnings for November of $30,201, an increase of $3,516 as compared with the same month of last year, and net, $14,528, an increase of $1,607. For the five months ending November 30, the gross earnings were $158,978, an increase of $19,628 as compared with the corresponding period of last year, and net, $73,395, an increase of $985. Surplus, $17,241.

Scribner's Magazine began with January, 1887. The issue for January, 1897, celebrates the opening of a new decade. A great programme has been announced for the coming year, and several of the schemes will begin in the January issue—notably the series on "The Conduct of Great Businesses," beginning with "The Department Store," described by Samuel Hopkins Adams, of the New York *Sun*, and illustrated from actual scenes by W. R. Leigh.

The ELECTRICAL REVIEW is indebted to Mr. George H. Daniels, general passenger agent of the New York Central & Hudson River Railroad, for a copy of the souvenir of the recent visit of Prince Hilkoff to this country. The Prince is the Imperial Minister of Ways and Communication of Russia, and is recognized as one of the great railroad men of the world. While in this country he was entertained by the leading railroad men, and was shown the many attractions and modern practice of the New York Central under the intelligent guidance of Mr. Daniels. In addition to excellent pictures of the Prince and party, the very interesting souvenir contains the Oriental visages of Li Hung Chang, of China, and Field Marshal Yamagata, of Japan, also recent visitors to the United States and travellers over this great railroad.

"Bill," the Electric Light Inspector.

Bill was appointed Inspector of Electric Lights, says a writer in the New York *Press*.

"But I don't know anything about electric lights," says Bill, who is too honest for his own good, always.

"You know when an electric light is burning, don't you?" says the main guy, gruffly.

Bill says that he knows that much.

"Well, when it's burning it's all right, and it don't need any more inspection," says the main guy. "Ain't that enough for you?" Bill says that it is.

"Isn't there anything more I can do for you?" says Bill, finally, when he sees that the main guy has gone back to his other work. The main guy is dead impatient by this time and he raises his voice.

"Come around once a month and draw your pay," he says, "and keep away from the office all the rest of the time."

And they tell me that Bill was one of the most successful inspectors of electric lights that they ever had in those good old Tammany days.

Street Railways in Massachusetts.

Within the confines of the State of Massachusetts there are 61 separate and distinct street railway systems, representing a value of $59,220,717, besides numerous leased lines, several systems which are not now in operation and a number which are only partly completed. The net earnings of these roads during the last year were $4,163,556, and of this sum the West End has earned $2,007,339 net. Some of the little country roads have not done so well as this. The Beverly & Danvers came out of it with only $38.11 as the result of the year's work, and some of them have finished with a balance on the wrong side of the books. Nine new roads have been started in the course of the year, and are now in full operation, and besides this a large amount of extension has been done by the roads already running. Of new track laid by the old roads there have been 2,292,792 feet, and the large extent to which electricity has been employed is shown by the fact that of this amount 2,039,423 feet have been equipped with electrical apparatus.

Trolley Car Speed in Brooklyn, N. Y.

The Appellate Division of the Supreme Court has rendered a decision upholding the validity of the trolley speed ordinance adopted about two years ago by the Brooklyn, N. Y., Board of Aldermen. In a test case, Civil Justice Neu held one of the trolley companies responsible for violating the ordinance, and imposed a fine of $25, but County Judge Aspinall reversed his decision. The Appellate Court has now sustained Justice Neu. The ordinance provides for the running of the cars at various rates of speed within the city limits, and it is the intention of the authorities strictly to enforce it. The case will now probably be carried to the Court of Appeals.

How Twenty-five Hundred Volts Feel.

[*From the London Lancet.*]

The following details of a recent electric accident are interesting and may be useful. On November 20 an electrical engineer was standing on a chair ready to move a reversing switch on the arc lamp side of a rectifier for lighting a series of 60 lamps (3,000 volts). He casually placed his hand on the metal cover of an ammeter (which was in series with another 60-lamp circuit), and, turning to the left and leaning back to make an observation (still standing on the chair), he placed his left hand on an iron pillar. Now, the ammeter case proved to be in metallic contact (accidental) with the light leads, and as the return wire was "earthed" there played through the body, from hand to hand, a current under a pressure of (nominally) 3,000 volts. As a matter of fact, the electro-motive force, tested between the points of contact by a Kelvin electro-static voltmeter, proved to be 2,500 volts.

He says that the first thing he realized was that he found himself standing on the floor, but has no idea as to whether he jumped off or was "knocked off." The forearm was "drawn up close to the chest" and the hands clenched. From a little above the elbow downward he described a "feeling of pulsation" and a violent beating in exact step with the alternators (running 83 periods per second). All power of movement below the elbow was absolutely lost, but the arm at the shoulder could be moved from the side. The pulsations, although still retaining their periodicity, soon became less violent, and motor power returned successively in the muscles that move the elbow, wrist and fingers. In three minutes he felt "none the worse." There was no sensation of burning at the moment, but 10 minutes afterward the hands became painful, and examination showed a burn on the tip of the left middle and ring fingers and on the back of the right little and ring fingers, with a seared line across the lower portion of the palm. There has been no other effect, excepting that he expresses himself as feeling "decidedly better in general health."

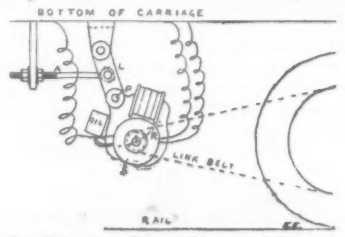
Which current did the body receive? With the contacts named, I estimate that the resistance of the body might be 10,000 ohms.

McClure's Magazine will begin in the January number a series of "Life Portraits of Great Americans," with reproductions of all the existing portraits of Benjamin Franklin known to have been made from life. There are 15 portraits, and some of them have never been published. Mr. Charles Henry Hart, probably the highest authority on early American portraits, is collecting and editing the material for the series, and will add introduction and notes giving the history of the several portraits, and whatever is interesting in the circumstances of their production. There will also be an article on Franklin by Professor Treat, of the University of the South. The same number will also contain a description of the making and laying of an Atlantic cable, with pictures illustrating all the interesting points.

An Electric Train-Lighting Device.

The Southeastern Railway Company, of England, has recently put into service a swell train equipped with a new device for electric lighting. This apparatus was supplied by J. Stone & Company, and is described in a recent issue of the London *Electrical Engineer*, from which the accompanying diagram is taken.

Each car is equipped with its own dynamo and accumulators, so that it is completely self-contained. The dynamo is driven by means of a two and one-half-inch link belt from a pulley on one of the axles of the carriage. The novelty in the system is the means of getting constant voltage independent of the speed at which the train is going. Instead of allowing the speed of the dynamo to vary, and regulating the magnetic field to correct for this, the dynamo is suspended so that its weight gives the necessary tension to the belt. The weight of the machine and the torque on the armature then exactly balance each other at normal output. Any further effort causes the dynamo



An Electric Train-Lighting Device.

to be pulled nearer to the driving axle. This slackens the belt and allows it to slip over the dynamo pulley. Thus a condition of equilibrium is reached, and a further increase of speed is impossible. In the older types the dynamo was hinged directly on to the bottom of the carriage. Now the arrangement shown in the diagram has been adopted, and the addition of the extra link L gives a greater range to the possible output. With this link in the dynamo hinges about the point P, the center of the armature describing the arc R. The rod A then provides means for shifting the position of the point of support P relatively to the center of gravity of the dynamo. In this way the critical speed, and hence the output of the machine, can be varied easily; also any alteration due to stretching of the belt can be corrected without the somewhat lengthy process of taking out links. The general design of the dynamo itself can be seen from the illustration, but all the parts are incased in dust and damp-proof covers. Arrangements are made in the case so that the armature connections are reversed with a reversal of direction of rotation. An automatic switch, worked by a small governor on the shaft, closes first the shunt circuit and then the main circuit as the speed increases to the normal. The inverse operation takes place as the train slows up. The accumulators, which are of ample capacity, are placed in two wooden boxes under the car. One of these boxes is fixed on each side exactly under the center of the car. The lids are easily reversed, giving ready access to the cells. There are 16 of these to each car, the plates being contained in teak boxes. The dynamos on these cars give about 35 amperes at full load. The lamps used throughout are of 10 candle-power at 30 volts.

The lamps in each car are controlled from the attendant's recess. A switch in this turns one-half or the whole of the lamps, as may be required. In the daytime half the lamps only are burning, but the dynamos are then charging the batteries. Near the switch a small ammeter is fixed so that the current given by the dynamos at any time may be read. This indicates when the rod A needs to be tightened up. The bulk of the fittings used are of polished wrought brasswork and carry two lamps. In the smoking compartments there are a few single-light wall brackets of a similar type, and in the lavatory and vestibules a simple bronze bracket is used.

TELEPHONE NEWS AND COMMENT.

There is talk of building a new telephone line from Walton to Delhi and Stamford, N. Y.,—37 miles.

Walton, N. Y., is building an exchange of perhaps 50 instruments. Joseph Beckwith and S. P. Wilbur are the leaders in the enterprise.

Sidney Centre and Young's Station, N. Y., have a new telephone line connecting with the exchange at Sidney. Messrs. Mauzer & Haight are the owners, and John Spickerman is the builder of the line.

It is now expected that the estate of the late Henry C. Cranston, formerly president of the Providence, R. I., Telephone Company, will pay 50 cents on the dollar. Mr. Cranston's liabilities amounted to almost $300,000.

Mrs. Dan Howard, a member of the Presbyterian Church at Jeffersonville, Ind., who is often prevented by illness from going to church, has had her home connected by telephone with the church. W. S. Jacobs then had his house connected with the Methodist Church for the benefit of his wife. In the neighboring town of Charlestown, Mrs. Jennie Y. Bean has had her house connected with the Presbyterian Church there, and the Louisville, Ky., *Evening Post* says that other Indianians are making similar arrangements.

The directors of the American Bell Telephone Company on December 16 declared a regular quarterly dividend of three per cent and one and one-half per cent extra. Dividends are payable January 15 to stock of record December 31. Books close at close of business, December 31, and reopen January 16. The last extra dividend was one and one-half per cent, declared June 10, payable July 15, and with the previous extra dividend of one and one-half per cent paid January 15, makes 15 per cent for this calendar year—12 per cent regular and three per cent extra.

Upton Long-Burning Arc Lamp.

The Standard Thermometer and Electric Company, Peabody, Mass., has always endeavored to meet promptly any improvements in arc-lamp manufacture, and, with the advent of the long-burning arc lamp, it commenced to experiment in this direction, finally producing a lamp of this nature, which it claims has such superior qualities as to command quick success. The new long-burning lamp this company now presents, and which is illustrated herewith, is beautiful in appearance and combines perfect steadiness of burning and light. It encroaches upon important footholds of the incandescent lamp in that in its construction it permits of satisfactory operation, whether made 12 or 36 inches in length, thus admirably adapting it for show windows, low ceilings, etc.

The lamp is made in 11 parts, including resistance, inner globe, outer globe and cover.

The central feature is a brass pipe, which acts as a support for the solenoid, guide for the carbon holder and cylindrical armature and, at the same time, is the skeleton or frame for the lamp. The solenoid, which is a perfectly ventilated magnet, is made large enough to admit of its being easily slipped over the top of the brass pipe and rests on a ventilated shoulder on the pipe.

The cylindrical armature, which acts as carbon rod, controller of the arc and dash pot, is made of a metal influenced by magnetism and threaded at the lower end so as to receive the carbon holder, and travels inside of the brass pipe.

The upper carbon holder, which is screwed to the end of the cylindrical armature, is a new and entirely novel feature. The carbon is slipped into the clamp, which automatically makes a good contact and positive alignment. The construction of the carbon holder is such as to provide for any expansion or contraction developed in the lamp, and makes it impossible for the carbon to drop out.

The cap is screwed on to the top of the brass pipe and makes an air-tight joint, also serving as the base to which the insulating lamp hanger is attached. This cap extends downwards in the shape of a rod, at the lower end of which is an enlargement which serves as a plunger for the dash pot.

The support for the inner globe is provided with a threaded hole and is screwed on to the thread on the base of the brass pipe, thus making an air-tight passage for the carbon. The lower portion is flange shaped and threaded on the inside to receive the inner globe.

The inner globe is provided with a thread at the top, which fits into its holder, and when in position forms an air-tight joint between the inner globe and its holder. The lower carbon-holding device also serves to hermetically seal the lower part of the inner globe, and like the upper carbon holder, automatically aligns the carbon and provides for expansion and contraction. The turn of one thumb-screw at the same time fastens the carbon and seals the inner globe.

The resistance is fitted beneath the solenoid to the brass pipe, and is provided with a changeable cut-out, enabling the lamp to burn on a variable voltage. The outer globe has no opening at the bottom, and at the top is provided with a clamp which holds it firmly to the lower portion of the cover, thus forming a shadowless support.

The salient features of this lamp, to which the manufacturers invite attention, can be briefly summed up as follows:

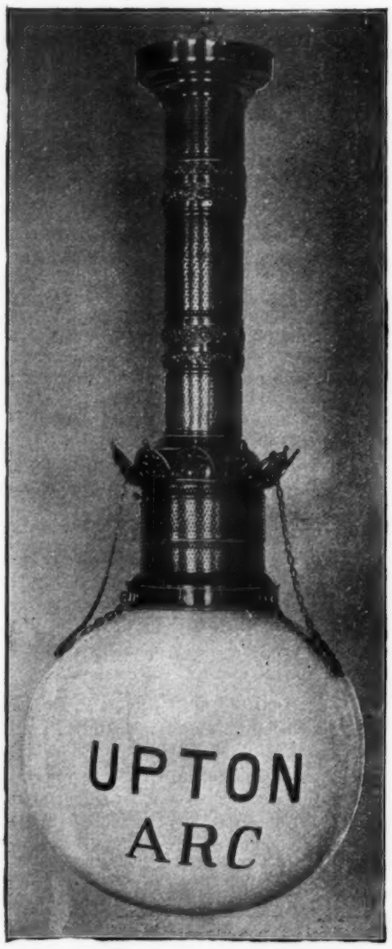
It is absolutely free from mechanism; it has no parts to wear or become gummed; no carbon or guide rods to polish.

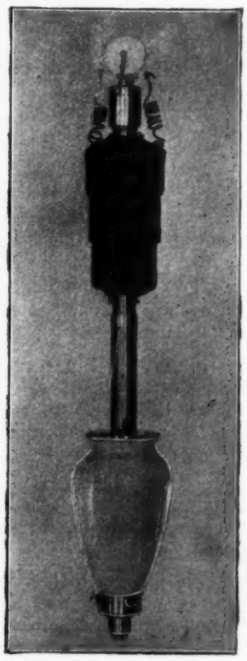
In placing the resistance under the solenoid, instead of above and close to the ceiling, the fire hazard is reduced to a minimum and objections of insurance inspectors are overcome.

The absence of all clutches, gears, frictions and other methods for escapement of the carbon insures an absolutely steady white light. The arc-controlling device maintains a steady voltage at the arc, overcoming the blue-tinted light occasioned by improper escapement mechanism.

The method of securing the inner and outer globe renders the lamp entirely free from shadow, and the trimming arrangements of the lamp reduce the labor to a minimum.

This lamp was designed by Mr. Henry Hallberg, electrician for the company.





FIGS. 1 AND 2.—THE UPTON LONG-BURNING ARC LAMP.

New Plant for the Brooklyn Edison Company.

Mr. E. W. Bliss has sold to the Edison Electric Illuminating Company of Brooklyn, N. Y., one of the most valuable shore-front properties in that city. The consideration is placed at about $260,000, and by the Fall of 1897 a new plant will be in full operation on the property adjoining the piers of the Long Island Railroad Company at Sixty-sixth street.

The property involved has dimensions of 260 by 1,150 feet, giving a water frontage of 260 feet, with rights to 550 feet under water and 600 feet back of the bulkhead line, lying between Sixty-sixth street and Wakeman place, taking half of the block from the water front to First avenue. The peculiarity of this piece of land is that it gives deep water at the water line, being in the track of the current which swerves off beyond it, and that solid ground is had within 100 feet of low water-mark.

It is the intention of the Edison company of Brooklyn, as soon as the weather permits, to construct a steam plant for generating electricity of an aggregate capacity of 120,000 horse-power, which will probably be the most economically appointed plant of its kind in the world. The buildings and machinery will cost about $300,000.

It is expected that current will be furnished from this plant as far as Babylon on the south side of Long Island, Roslyn on the north and Garden City and Hempstead in the center.

The Equitable Gas and Electric Company, of Utica, N. Y., has declared a quarterly dividend of one and one-quarter per cent, payable January 15.

A Big Electric Plant for a Steam Road.

The General Electric Company has just closed with the New York, New Haven & Hartford Railroad Company one of the largest contracts ever placed for electric railway equipment. The full contract has not been signed, only a part of it, but negotiations have all been closed and remaining contracts will be signed from time to time. The contract calls for building a power-house at Berlin, Ct., which will be four times as large in capacity as the power-house at Nantasket. This is the important contract and it has been signed.

A contract has partly been closed for equipping the New Haven road with the third-rail system between Hartford and New Britain, Hartford and Waterbury, and Hartford and Meriden, the power to be supplied from Berlin, Ct., power-house, which will also furnish power for the New England Railroad between New Britain and Hartford. Contracts have also been partially closed for lighting the New Haven shops at Hartford with electricity and also all the stations between points above mentioned.

A New X-Ray Book.

"A B C of the X Ray" is the title of a new book by Mr. Wm. H. Meadowcroft. It is a 12mo. volume of 189 pages, containing 37 illustrations. It is bound in two styles—cloth at 75 cents and paper at 50 cents. The book will be sent, postage free, by the ELECTRICAL REVIEW, 41 Park Row, New York city, on receipt of price.

The author has succeeded in treating his subject so that any one, after reading the book, will understand the several forms of X-ray apparatus now on the market, and will be able to select and operate the apparatus himself. It would not be surprising if this latest work of Mr. Meadowcroft equaled in popularity his well known "A B C of Electricity," of which 60,000 have been sold.

Lake Shore Calendar for 1897.

The 1897 calendar of the Lake Shore & Michigan Southern Railway is one of the most pleasing and unique calendars ever issued. The design is a government mail pouch (the Lake Shore's trade-mark) richly printed in brown and gold on heavy enameled cardboard, size 8 by 15 inches. It will be sent free anywhere on receipt of six cents in postage to cover mailing, by applying to A. J. Smith, Gen. Pass. & Tkt. Agent, Cleveland, Ohio.

Chicago Electrical Association.

The Chicago Electrical Association last week elected the following officers for 1897: S. G. McMeen, president; F. S. Hickok, vice-president; E. J. Jenness, treasurer; H. Cochrane, auditor, and J. R. Cravath (re-elected), secretary and librarian. The directors chosen were W. Clyde Jones, G. W. Knox and Kempster B. Miller.